BULLETIN 32

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Atlantic City Steel Paint Tests

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NOTES ON A RECENT STUDY OF THE ATLANTIC CITY STEEL PAINT TESTS

By Henry A. Gardner,
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A recent inspection of the painted steel test panels* erected by the Paint Manufacturers' Association at Atlantic City during October, 1908, has disclosed some startling changes in the weathering of the various paints as compared to their condition a year ago. These tests, which include a great number of oil paints, are affording most important information as to the comparative value of various pigments, when ground in linseed oil, as protective coatings for ferrous metals. Several of the paints have given excellent results, while others have completely failed to serve their intended purpose. The original contention upon which the tests were based, that pigments of the rust inhibitive and inert types, such as the slightly soluble chromates, the basic compounds, and the metallic oxides, would prove superior to those pigments of the tentatively termed rust stimulative class, which induce electrolysis either through the effect of

* Bulletin 27, Paint Mfrs. Asso. of the U. S. "Corrosion of Iron and Steel," Cushman and Gardner: McGraw-Hill Book Co., N. Y.

contained acid impurities or through their electro-negative nature, has been fully justified.

While some single-pigment paints have failed in certain respects, it is by no means certain that these paints would act in the same way under conditions of actual practice where they would be used in combination with other pigments which might tend to overcome their inherent defects. This statement would apply especially to pigments of the inert class, such, for instance, as barytes or whiting. These pigments are never used alone in paints. They are always combined with some of the more opaque pigments in order that their defects may be corrected, sometimes lending in turn a strengthening effect to the pigments with which they are combined. This point is well illustrated in tests Nos. 19 and 21, in which the pigment Barytes seems to have had the effect of prolonging the life of the black carbon pigments with which it was combined.

Panel No. 1, painted with Old Dutch Process White Lead (Basic Carbonate-White Lead), and Panel No. 2, painted with Quick Process White Lead (Basic Carbonate-White Lead), are both in very poor condition, their surfaces being covered with rust streaks which appear wherever brush marks were shown at the initial painting. Early in the test these panels developed considerable chalking, which was progressively washed off to such an extent that in the summer of 1911

a very thin coating was left. This coating during the past year has failed in a great many places, scaling and marked signs of disintegration having appeared.

Panel No. 3, painted with Zinc Oxide, indicated at the beginning of the test that the paint used was too stiff and thus lacking in elasticity; Zinc Oxide being a pigment which demands a considerable quantity of oil. The rust lines on the paint, where the brush marks were left, are heavy. What remains of the paint, however, is very hard, and beneath the surface the steel is clean, indicating that the pigment itself is of an inhibitive nature.

Panel No. 4, painted with Basic Sulphate-White Lead, and Panel No. 5, painted with Sublimed Blue Lead, are both in excellent condition. Although considerable chalking was shown on each of these panels, the paint films are intact and of a tough, elastic nature, presenting to the touch a velvety feeling. The Sublimed Blue Lead was somewhat superior to the Basic Sulphate-White Lead, although the latter showed better color maintenance.

Panel No. 6, painted with Lithopone, indicated at the beginning of the test that this pigment when used alone was unfit for the protection of iron and steel exposed to the weather. The panel at the present time is covered with rust beneath the surface of the film, and in some places the rust has broken through and disrupted the coating. The

coating is very dark in appearance, having fogged considerably through the action of light.

Panel No. 7, painted with Zinc Lead, is streaked with dark brown rust wherever the brush marks were formerly apparent.

At the beginning of the test Panel No. 9, painted with American Orange Mineral, and Panel No. 10, painted with Red Lead, gave excellent service. Until last year these panels were in perfect condition except for a whitening of the surface which is probably due to the formation of a coating of white carbonate of lead, effected by the carbonic acid of the atmosphere, giving to the panels a pinkish tint. On panel No. 9 there are several slight rust spots appearing through the surface of the paint. Panel No. 10 is slightly darker than Panel No. 9, and has offered greater resistance to the destructive effect of the salt air.

Panel No. 12, painted with Bright Red Oxide, and Panel No. 14, painted with Venetian Red, are both in generally good condition, with the exception of a few rusty brush streaks on Panel No. 12 and a few slight corrosion spots on Panel No. 14.

Panel No. 15, painted with Metallic Brown Oxide, is also giving very good service except for the appearance on the paint film of several eruptions of pin-head size, which have apparently not broken through but which have lifted the paint coating slightly in spots.

Panel No. 16, painted with Natural Graphite,

shows several slight pin-head eruptions on the surface, as well as several deep corrosion spots spread about. Its surface is chalking considerably.

Panel No. 17, painted with Artificial Graphite, is uniformly covered with large rust spots, which are spreading over a wide area, and thousands of small pin-head eruptions. This panel is chalking heavily, the chalked surface resembling stove polish in appearance. The inferior condition of this panel as compared with Panel No. 16 (Natural Graphite) may be accounted for by the fact that Natural Graphite contains inert pigments such as silica and iron oxide.

Panel No. 19, painted with Lampblack and Barytes, is covered with small round pin-head eruptions which have not yet broken through. It also has a spotted and dull appearance and shows considerable chalking.

Panel No. 20, painted with Willow Charcoal, is the best appearing black of carbonaceous origin upon the fence. It has a deep color and is showing no corrosion nor chalking.

On Panel No. 21, painted with Gas Carbon Black and Barytes, there is considerable chalking with a few rust spots apparent. This type of black, however, is superior in appearance to No. 19.

Panel No. 24, painted with Ochre, is covered with many small rust eruptions as well as several very bad rust spots. The paint film has become

brown, due to the corroded surface beneath. The film itself, however, is intact.

Panel No. 27, painted with Natural Barytes, has scaled, and the paint that is left upon the surface is badly discolored with rust.

Panel No. 28, painted with Precipitated Barium Sulphate or Blanc Fixe, is also scaling, and the portion of the film that is intact is pin-holed, stained, and streaked.

Panels Nos. 29 and 30, painted respectively with Calcium Carbonate and Precipitated Calcium Carbonate, are covered with rust, no pigment being left upon the plates. At the start of the test these panels chalked to such an extent that the chalked surface was washed off by the rains before the test had weathered two years.

Panel No. 31, painted with Gypsum, is of a dark brown color and is showing several rusty streaks. Its surface is entirely covered with small pin-head eruptions.

Panel No. 32, painted with China Clay, is fairly white, and although there are a few rust streaks appearing, it is in fair condition.

Panel No. 33, painted with Asbestine, is in similar condition to Panel No. 32, the rust streaks being slightly more pronounced.

Panel No. 34, painted with American Vermilion (Basic Chromate of Lead), is in perfect condition.

Panel No. 36, painted with Lead Chromate, is streaked around the edges for a distance of six

inches with thin lateral and horizontal streaks of rust. The middle of the panel, however, is in good condition.

Panel No. 39, painted with Zinc Chromate, is in excellent condition.

Panel No. 40, painted with Zinc-and-Barium Chromate, has developed a slight greenish tint and a little chalking. Otherwise this panel is in excellent condition.

Panel No. 41, painted with Pure Chrome Green, is in perfect condition except for the development of a slight bluish tint along the edges.

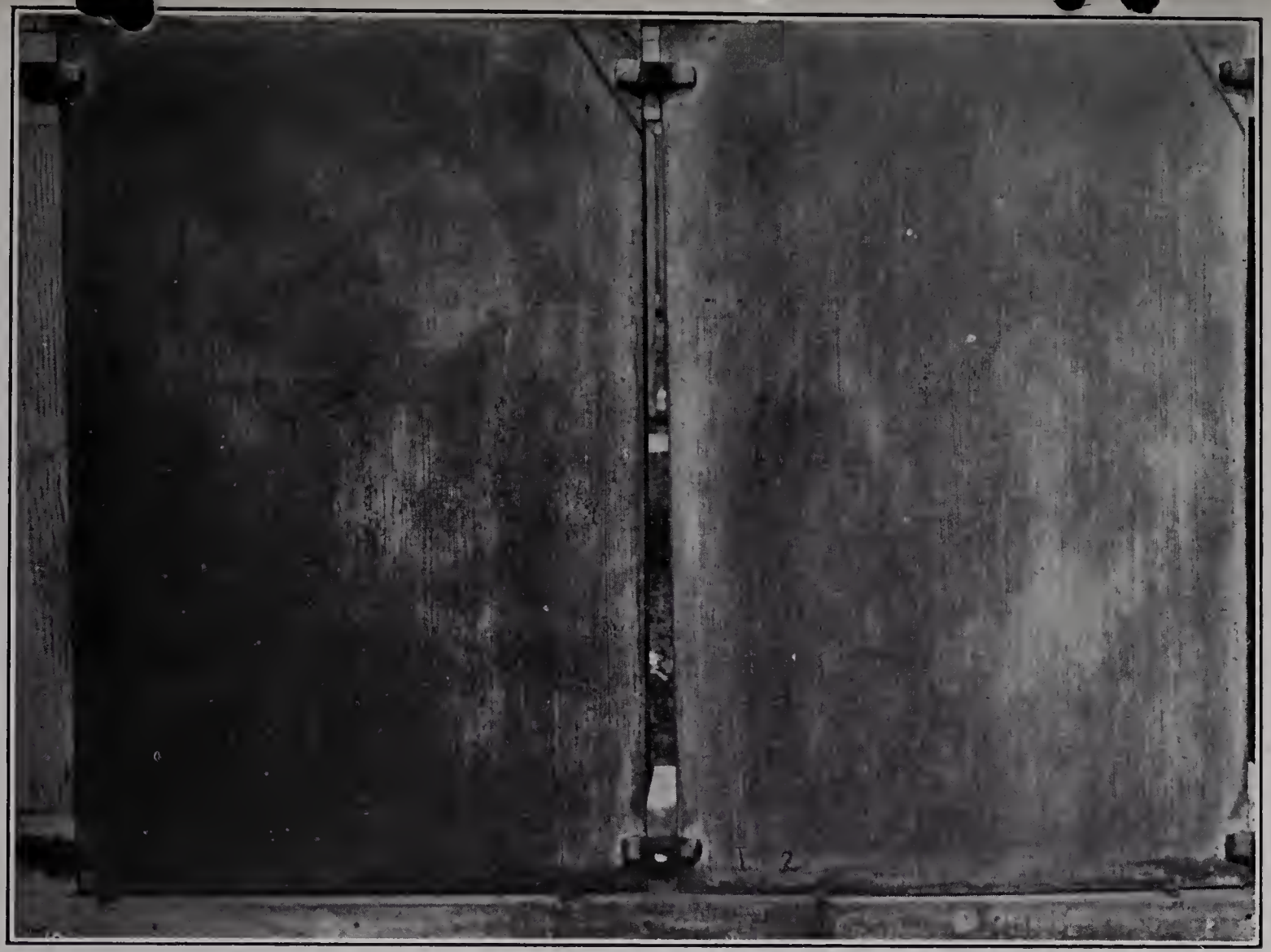
Panels Nos. 44 and 45, painted with Prussian Blue, are both in good condition. While Panel No. 44 has developed a slight greenish tint, Panel No. 45 is still evidencing a most brilliant maintenance of its dark blue color and gloss.

Panel No. 48, painted with Ultramarine Blue, is entirely covered with rust, the paint having chalked off completely.

Panel No. 49, painted with Zinc and Lead Chromate, is in perfect condition, with the exception of a few slight rust spots.

Panel No. 51, painted with Precipitated Black Oxide of Iron, is in good condition, with the exception of slight chalking.

Photographic Views of Some of the Panels on the Atlantic City Steel Test Fence

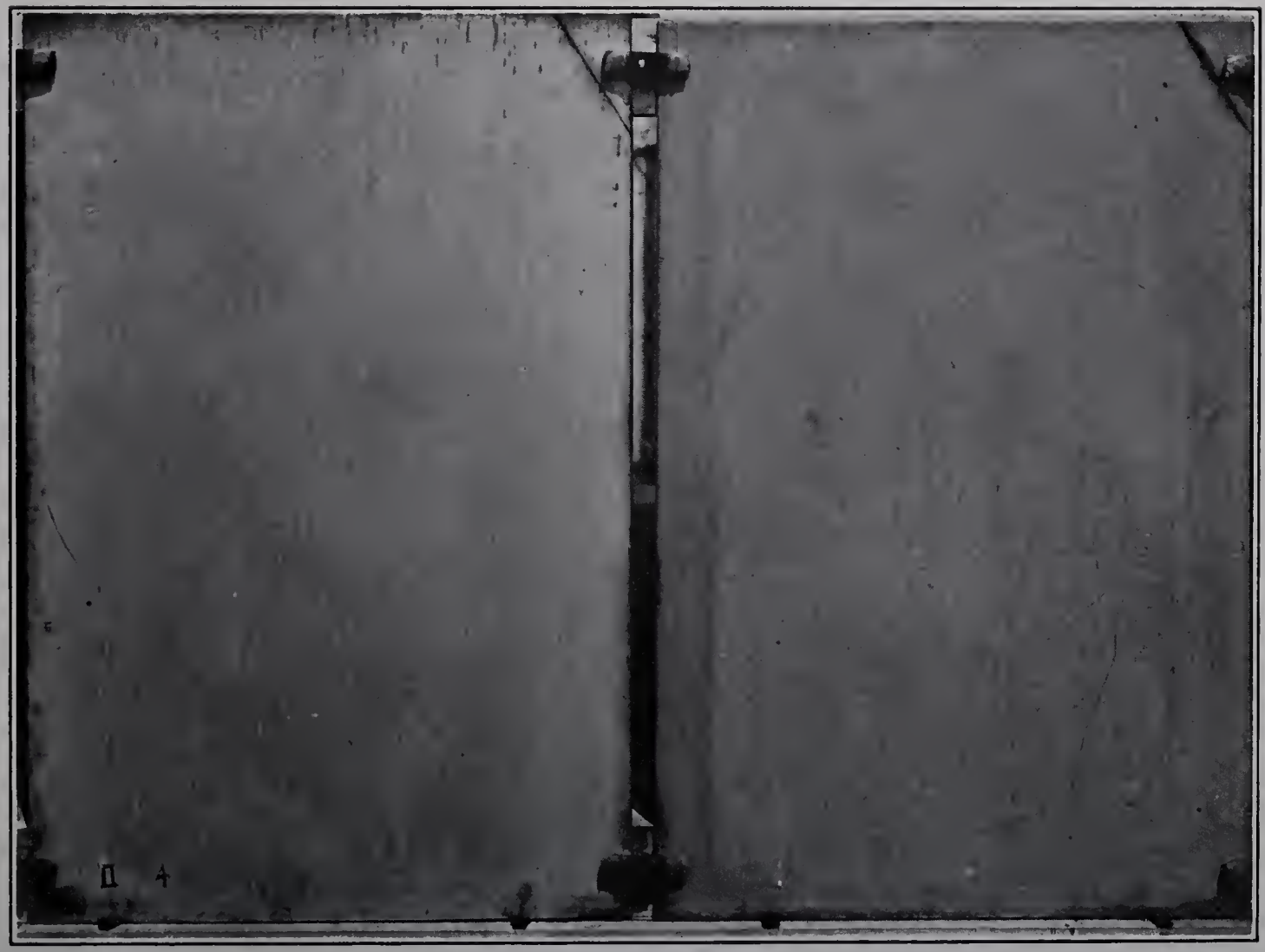


Panel No. 1 — Corroded White Lead (Basic Carbonate-White Lead), Old Dutch Process

Detail — April, 1912

Panel No. 2 — Corroded White Lead (Basic Carbonate-White Lead), Quick Process

(Note how the heavy rust streaks follow the brush marks.)



June, 1910

Panel No. 4
Sublimed White Lead (Basic Sulphate-White Lead)

Panel No. 5
Sublimed Blue Lead

Good condition of these basic pigments is shown by photograph.

Group, April, 1912

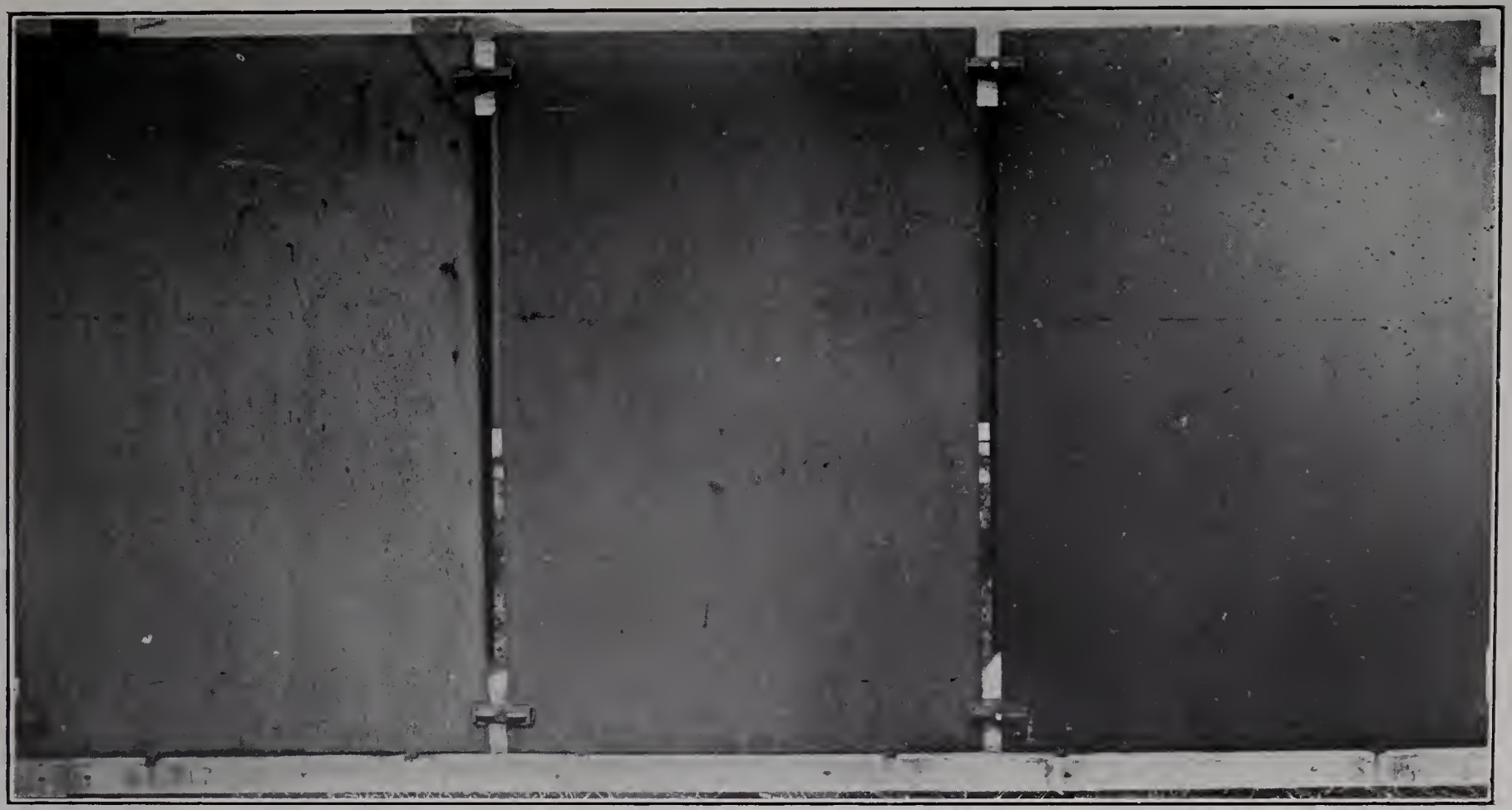
Panel No. 1	*Panel No. 2*	*Panel No. 3*	*Panel No. 4*	*Panel No 5*	*Panel No. 6*
Dutch process corroded white lead (basic carbonate-white lead)	Quick process corroded white lead (basic carbonate-white lead)	Zinc Oxide	Sublimed white lead (basic sulphate-white lead)	Sublimed blue lead	Lithopone: 70% barium sulphate, 30% zinc sulphide

(View of some of the lead and zinc pigments.)

April, 1912

Panel No. 7	*Panel No. 9*	*Panel No. 10*	*Panel No. 12*	*Panel No. 14*
Zinc lead 50% zinc oxide 50% lead sulphate	Orange mineral (red lead)	Red lead	Bright red oxide of iron	Venetian red (oxide of iron containing calcium sulphate)

Marks on panels 9 and 10 were made at inspection by rubbing whitened surface. The red color of the red lead is shown where whitened surface was removed. (See report.)

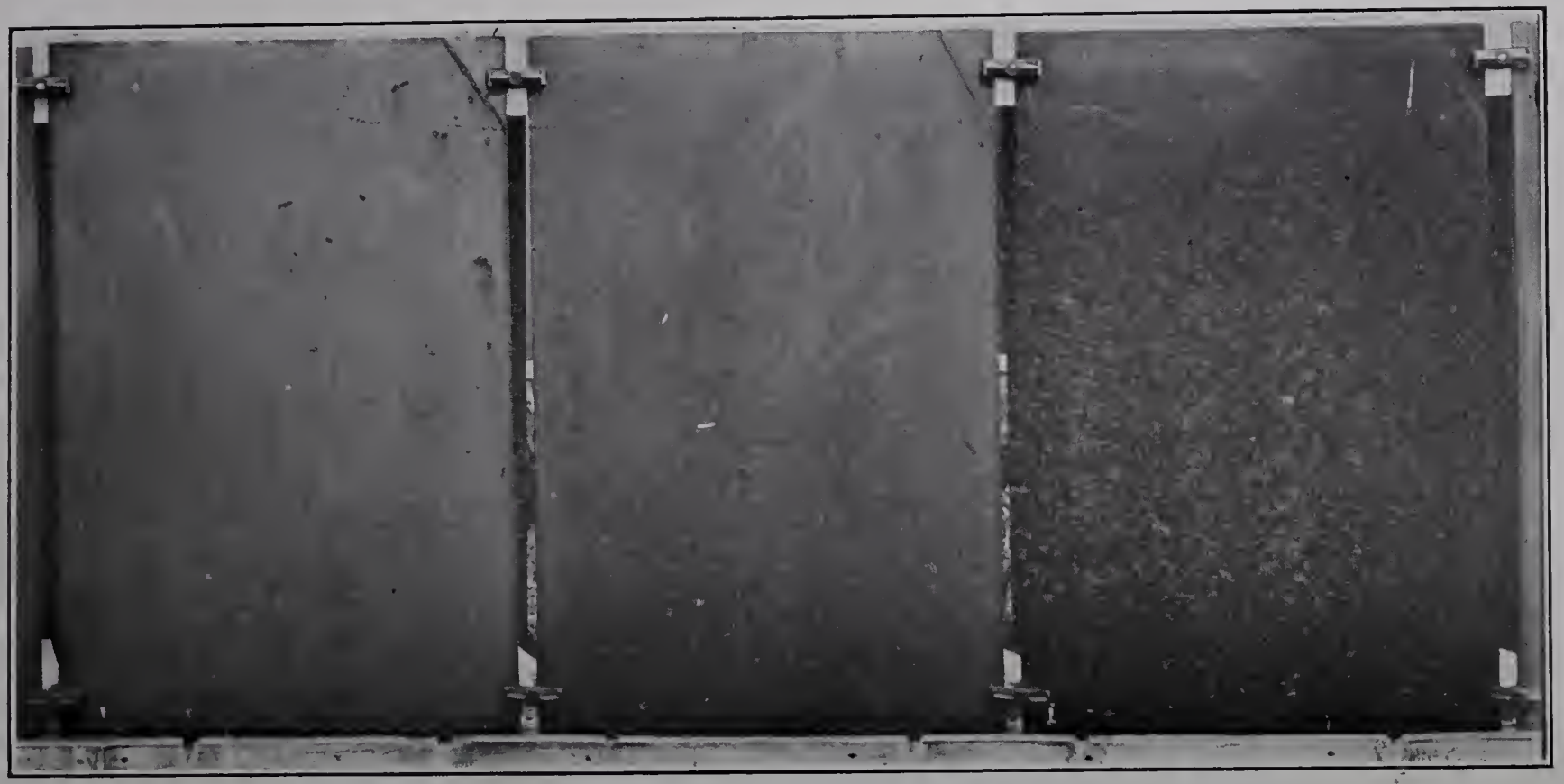


April, 1912

Panel No. 17
Artificial Graphite

Panel No. 19
Lampblack and Baryites

Panel No. 20
Willow Charcoal



June, 1910

Panel No. 17
Artificial Graphite

Panel No. 19
Lampblack and Barytes

Panel No. 20
Willow Charcoal

April, 1912

Panel No. 34	*Panel No. 36*	*Panel No. 39*	*Panel No. 40*	*Panel No. 41*	*Panel No. 44*
American vermilion (basic chromate of lead)	Lead chromate	Zinc chromate	Zinc-and-barium chromate	Chrome green	Prussian blue

(Note excellent condition of rust-inhibitive pigment paints.)

June, 1910

American Vermilion (Basic Chromate of Lead)

Panel 6666

Corrosion pits on panel painted with stimulative pigment

June, 1910